

BOARD OF AGRICULTURE AND FISHERIES.

The Construction of Cow-houses.

The first requirement in the production of milk for human consumption is cleanliness, and one of the most important factors in securing clean milk is a well constructed cowshed.

It is comparatively easy to provide new buildings which will meet all requirements, but it is more difficult to alter an existing building so that it can be made as suitable as a new one. This fact, however, should not deter owners and occupiers from making alterations on the lines suggested, as even the most unsatisfactory buildings can often be much improved without great expense.

In designing a cow-house, the principal details which should receive consideration are the following :—

Site, including aspect and arrangement with regard to other buildings ;

General Construction of the Building, including the walls, roof, floor, drainage, and water supply ;

Internal Design, including arrangement of stalls, stall divisions, feeding troughs, manure and urine channels, and passages ;

Air Space and Floor Space ;

Ventilation, including the various methods by which this is attained ; and

Lighting.

The Site.

If possible, the site should be moderately high and dry ground. The building should be conveniently placed for the supply of fodder and roots and the preparation and storage of feeding stuffs. In order to facilitate the removal of the manure and urine, the site should, where practicable, be on ground with a gentle slope.

There should be easy and ample access to the nearest pasture without interference with other stock, and without affording the cattle an opportunity to stray. To ensure ample sunlight a south, south-east, or south-west aspect is desirable,

and, while it should be sheltered from strong winds as far as possible, no cow-house should have any buildings, such as hay or straw sheds, or buildings occupied by other kinds of stock, erected against the side walls. In designing new farm buildings these points can be taken into consideration, but when existing buildings are being altered, difficulties may occur. With care and skill, however, the average building of the present day may be considerably improved.

General Construction.

Walls.—The walls may be of any suitable material which is plentiful and cheap in the district, and with the necessary precautions good buildings may be erected of stone, brick, concrete, wood, or wood and iron. If of stone or brick, all the walls should be neatly pointed, and, where economic considerations permit, it adds to the cleanly appearance and sanitary efficiency of the building if the inside face of the walls is built with salt-glazed bricks or cement finished with a smooth surface to a height of not less than 5 ft. from the floor. Above that height the surface of the walls should be of such a nature that they can be easily cleaned and disinfected or lime-washed. If the building is of wood, or wood and iron, all uprights, sills, and outer boarding should be of timber which has been creosoted under pressure. The extra expense of creosoting will not be great, while the life of the building will be considerably increased. To obtain sufficient cubic air space within the building the height of the walls should not as a rule be less than 8 ft. 6 in. from the threshold to the top of wall-plate.

Roof.—In recent years many kinds of roofing materials have been placed upon the market, and used with varying success, but for efficiency and endurance there is nothing to surpass slates or tiles. The building should be open to the ridge. In constructing the roof timbers, where the span does not exceed 30 ft., there is no cheaper or stronger form of support than the king-post principal for double cow-houses. For narrow spans for single cow-houses there are several kinds of roof trusses of simple design which can be adopted.

Doors.—The doors for the entrance and exit of the cows should be not less than 4 ft. wide in the clear, and should be hung in halves. Simplicity of construction should be aimed at, and it will be found that plain, strong ledged and braced doors are the most satisfactory and durable. The sharp angles of all door frames should be rounded off; and, where doors are hung in brick-

work, round-nosed bricks should be used to lessen the risk of injuries to the cows.

Floor.—The first point which should be considered in connection with the floor is its level compared with the existing roadway, or completed surface round the building. In many cases, particularly on level land, or where there is difficulty in getting sufficient fall for the drains, the floors are laid at too low a level, with the result that the floor and stalls are often damp, and the roadway outside is covered with mud and slush. In not a few instances the roadway outside is difficult to improve, as it cannot be raised, owing to the risk of running the surface water into the building, instead of away from it. Such conditions should be guarded against by laying the floor at a comparatively high level. If also the site does not slope so as to provide the requisite fall for purposes of drainage, the floor should be raised sufficiently to secure this.

The main flooring materials should be either cement concrete, or blue bricks. Where clean sharp sand and gravel are available, good cement concrete, not less than 4 in. in thickness, properly laid and finished, is probably the best material for general purposes. The finishing coat should be laid on as soon as the foundation concrete is sufficiently hard for walking upon, and before it is dry. This finishing coat should consist of two parts of finely crushed granite, and one part of cement, and should be at least 1 in. in thickness. The surface should be grooved or slightly roughened to prevent the animals from slipping. Care must be taken that the ground is quite even throughout, well rammed, and uniformly firm before laying the concrete. Properly finished concrete is scarcely ever slippery if clean, but may be more or less so if dirty. It is as cheap as any other flooring material laid equally substantially, is less absorbent than most, and probably more durable than any other. Where blue bricks are used for the passages and stalls, the bottom of the manure channel might be formed in cement so that there are no junctions to hold urine; the uniform gradient necessary for this part is also more easily maintained with cement than with bricks.

Whether the floor is made of cement concrete, or blue bricks, it will be advantageous to use rammed clay or chalk-rubble for a space of 3 feet from the manger, as this will enable the cows to kneel with greater comfort and will prevent enlarged knees.

Drainage.—There should be no covered drains inside the cow-house. The urine from the gutter should be carried off by means of a 6-in. glazed pipe, which should run through the wall and discharge 6 in. beyond over a trapped gully,

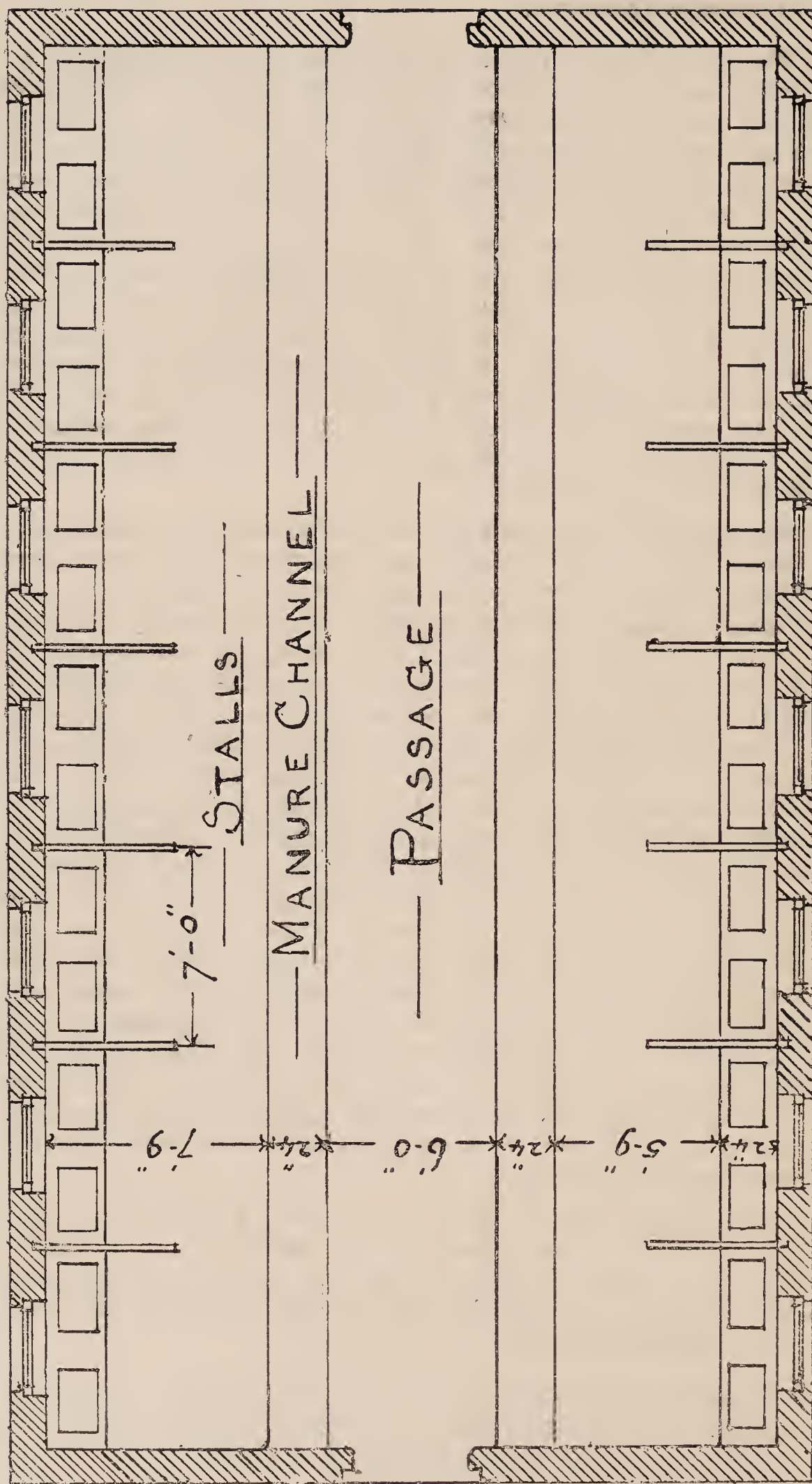


FIG. 1.—GROUND PLAN OF COW-HOUSE : TWO ROWS OF STALLS, WITHOUT FEEDING PASSAGE.

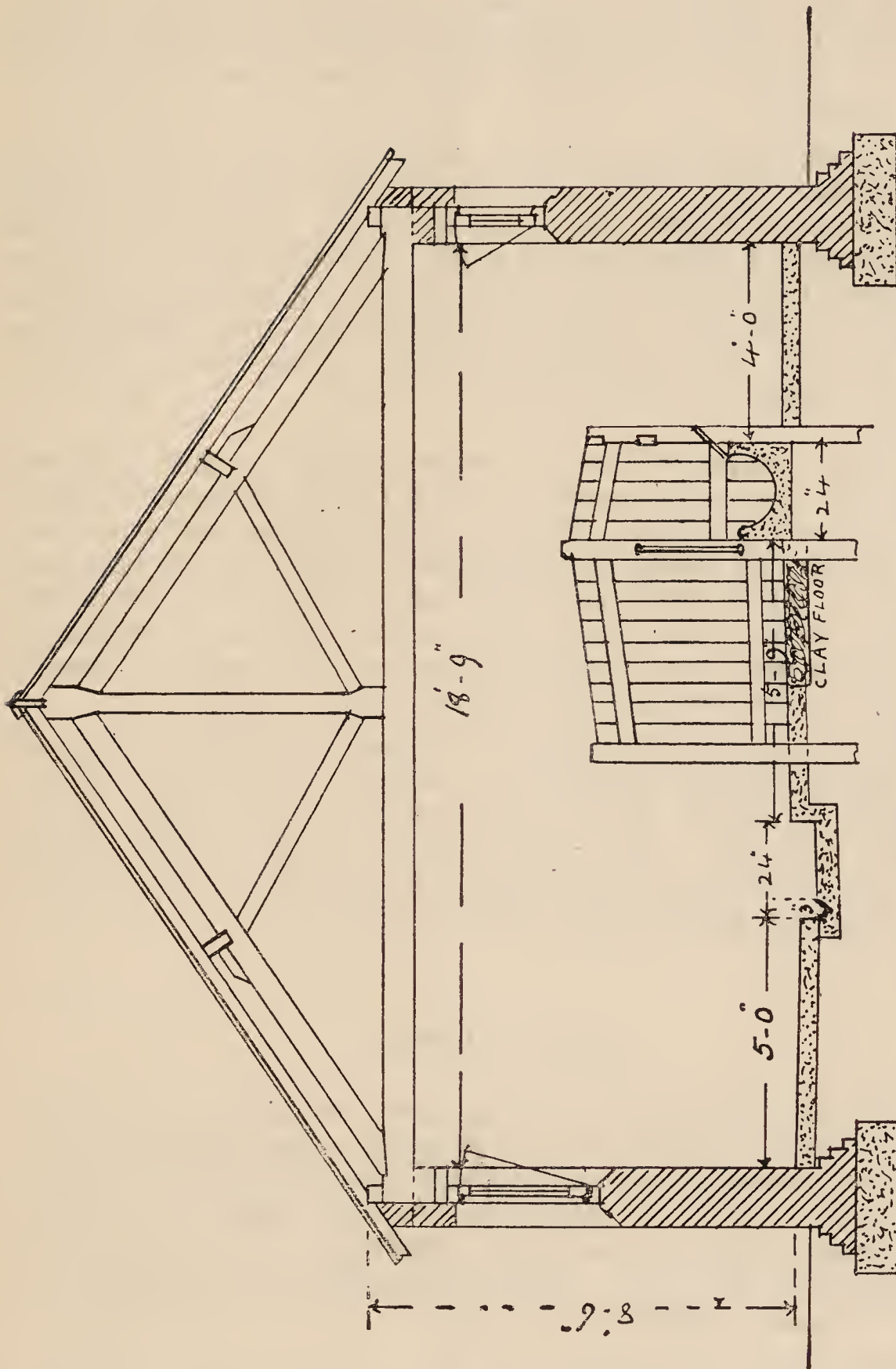


FIG. 2.—COW-HOUSE WITH ONE ROW OF STALLS AND FEEDING PASSAGE.

or to the manure in the case of a covered yard; a grid should be fixed at the end of the discharge pipe to prevent solids entering the drains. The drains outside the cow-house should be as short as possible, and should have a good fall, otherwise they will be difficult to keep clear. Where the drain is of considerable length, or bends to any extent, inspection chambers with loose covers should be introduced.

A good plan is to have a watertight tank close to the dungstead into which all leakage from the latter should run, and into which the drain from the cow-house should discharge. A urine tank in such a position permits of the contents being distributed over the top of the manure heap, though it is best to apply it direct to the land, especially to meadows.* For raising the contents of the tank a chain or plunger pump should be fitted.

Water Supply.—The best water supply is that obtained from springs and streams, or other suitable sources of pure water at a higher level than the buildings, so that water can be brought to them by gravitation, which is the cheapest method. If such sources are not available, the rain-water should be collected in storage tanks fixed at a sufficient height to supply the cooling room and cow-house; alternatively, well-water may be pumped up into tanks.

It is desirable to arrange for an ample supply of water to the cow-house for watering the stock, for cleansing, and for a washing basin where the men can wash their hands before milking. Any tank for the storage of water used for the washing of the milkers' hands or the cows' teats should be properly covered and ventilated.

Internal Designs.

General Arrangement.—In many parts of the country the most common type of cow-house is that represented in Fig. 1, in which the cows are stalled with their heads facing one of the outside walls. In this type the one passage is used for conveying food to the cows, removing the manure, and taking away the milk. This arrangement is applicable to either single or double cow-houses.

The interior dimensions of this building (Fig. 1) give a total distance from side to side of 25 ft. 6 in., and its narrower span would enable a simpler roof truss to be used than the alternative plan shown in Fig. 3.

* See Leaflet No. 93 (*Farmyard Manure*).

The method of stalling the animals shown in Fig. 2 is one of the most approved, particularly where existing farm buildings are being adapted ; where, however, a new building is to be erected for a large number of cows, it will be more economical to adopt design No. 1. In Fig. 2 the same principle is followed as in Fig. 3, except that one row of cows is provided for instead of two.

Where there are less than 12 cows, and they are ranged in a single row, a feeding passage is not necessary. One is often provided because it is a convenient way of obtaining the prescribed amount of cubic space in the cow-house ; but this end is often defeated in practice by the custom of using the feeding passage for the storage of fodder. This is an objectionable system, and it would be far preferable to dispense with the feeding passage and store the fodder in a mixing house at one end of the cow-house ; half the space in the mixing house could be included in reckoning the cubic space per cow, if it is only partially partitioned off from the cow-house.

The arrangement shown in Fig. 3 has a great deal to recommend it, and though the initial cost is fairly high, the advantages obtained may warrant the extra expense.

In one type of cow-house which is very common in many districts, and is frequently met with in most modern dairies in America and on the Continent, all the stock are fed from a central passage, while the manure and the milk are removed by the two passages at the side. In a building of this class the cows' heads are a long way from the fresh-air inlets, and the animals breathe into each others faces from opposite sides of the passage, so that exceptionally good ventilation is needed to maintain the general health of the cows. Moreover, such an arrangement is to be strongly deprecated as being likely to assist the spread of disease from animal to animal by inhalation.

Passages.—A feeding passage less than 3 ft. 6 ins. wide cannot be worked in with comfort, and a standard width of 4 ft. is preferable. The passage should have direct access to the mixing house or store.

Milking passages should be from 4 to 5 ft. wide for single cow-houses, and 5 ft. 6 in. to 6 ft. 6 in. for double ones. With a narrow passage there is always a risk of the cans and their contents being splashed and contaminated with urine or dung.

Stalls.—The floor of the stalls should be given a fall of about 2 in. from the trough to the manure channel ; this will facilitate the drying of the floor after flushing with water.

In determining the length of the stalls regard should be had to the breed to be kept.

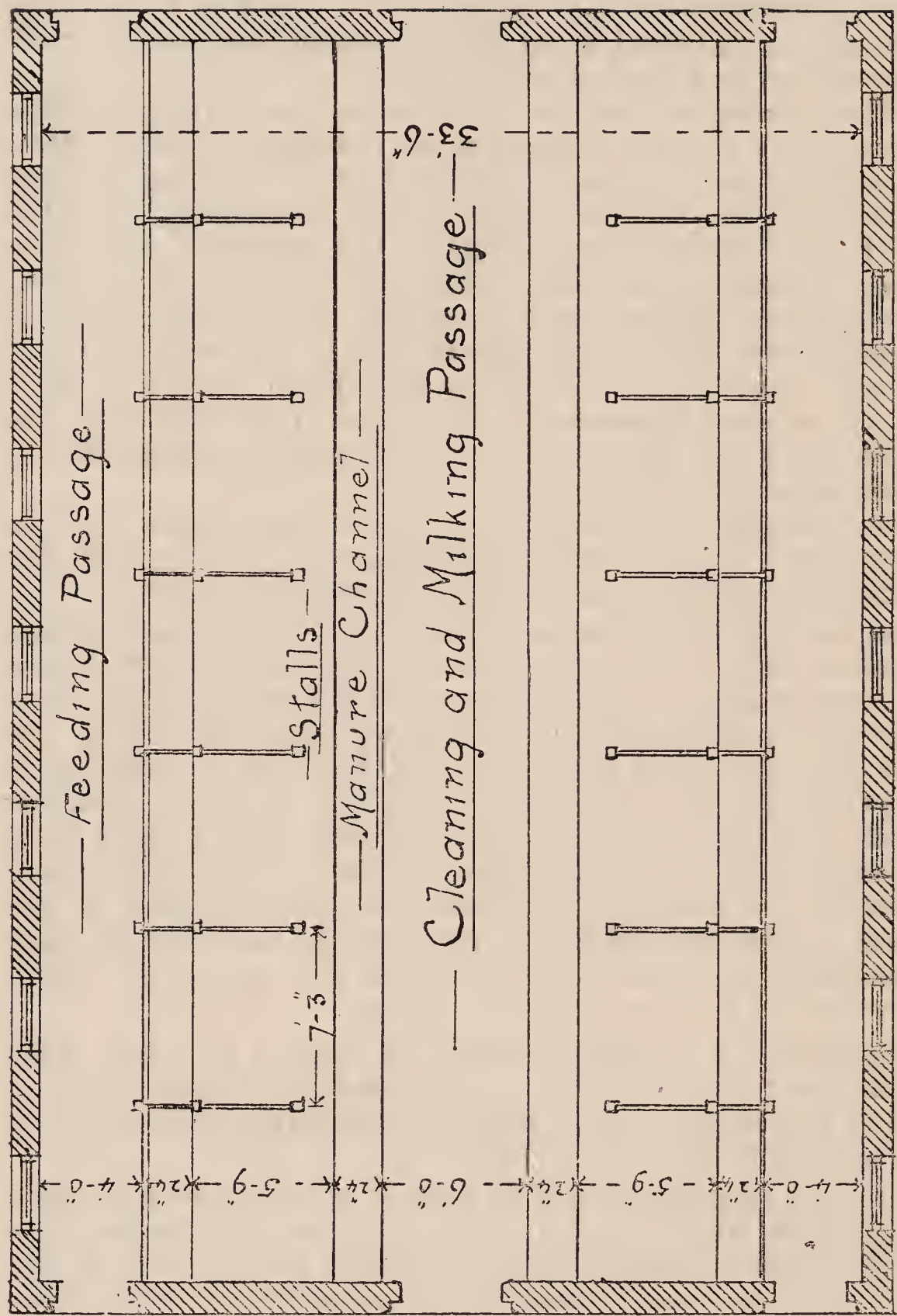


FIG. 3.—GROUND PLAN OF COW-HOUSE: TWO ROWS OF STALLS AND FEEDING PASSAGES.

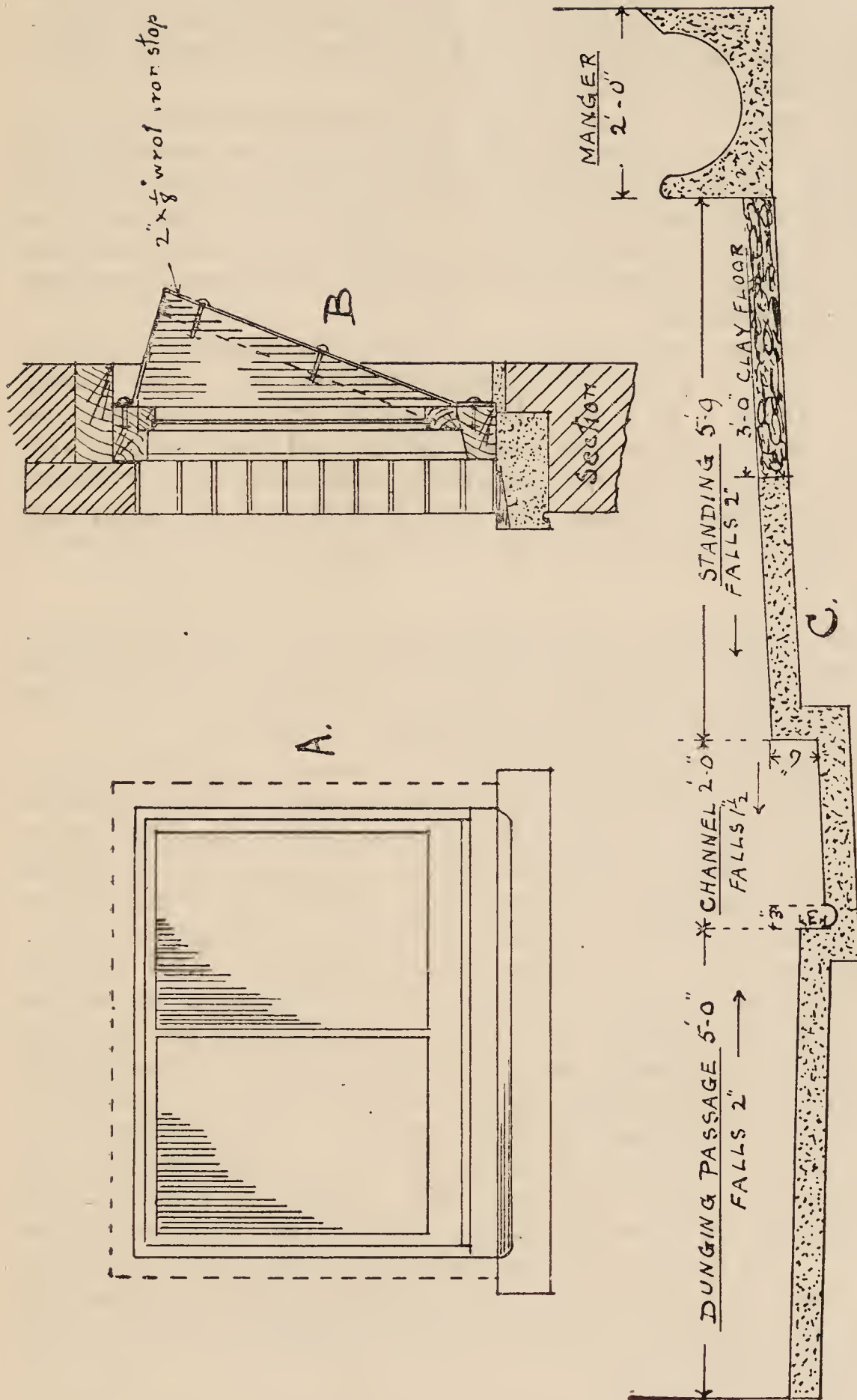


FIG. 4.—A. AND B. DETAILS OF HOPPER WINDOW. C. SECTION OF COW-HOUSE FLOOR: ONE ROW OF STALLS WITHOUT FEEDING PASSAGE.

For small cows, such as Jerseys, Kerrys, and young Ayrshires, the stall (measured from the manure channel to the wall or division between the cows and the passage) should be about 7 ft. long, inclusive of the breadth of the trough. For Ayrshires, a stall of 7 ft. 3 in. is quite sufficient, while Shorthorns require 7 ft. 6 in. to 8 ft.

If the stalls are too short, the cows will stand in the manure channel, and sooner or later their hind feet become soft and diseased. If the stalls are too long the cows drop their dung on to the floor, and when they lie down are almost sure to soil their hindquarters or udder. Under such conditions the labour necessary to keep the stalls and cows reasonably clean is much increased.

For the smaller cows, each double stall should be from 6 ft. 3 in. to 6 ft. 9 in. wide, and for the larger ones, from 7 ft. to 7 ft. 6 in. If the stalls are too narrow the cows tread on each other's legs, udder, and teats, and injury to the two latter almost invariably means loss of a quarter. If the stalls are too wide, the cows turn round in them, and drop urine or excrement in the trough, or on the floor of the stall.

Stall Divisions.—It is usual to stall the animals in pairs. The principal advantage of introducing divisions is that they render the cows less liable to disturbance, and prevent them from turning round and fouling their bed.

The stall divisions may be made of cement concrete, stone, wood, or iron. Wood is most generally used. The divisions should be of simple style to facilitate repairs. An illustration of a stall division is given in Fig. 2. A post 4 ft. 6 in. high, called the headpost, is placed close against the front of the manger, and another 4 ft. high, called the heelpost, 4 ft. 6 in. to the rear of it. Into these are mortised top and bottom rails for receiving the boarding, which is nailed upon one side only. A slighter post is placed at the back of the manger, in the feeding passage, to receive two short rails taking that section of the boarding which continues over the manger; the division extends to the bottom of the manger if a continuous feeding trough is formed. Occasionally the divisions are made with four rails instead of boards; this arrangement answers well and promotes the free circulation of air. The headpost by the feeding trough serves for tying up a cow on each side. Two $\frac{3}{4}$ -in. iron rods 2 ft. long, are bolted through the post, to these iron rings are attached for sliding up and down. The neck chains of the cows are affixed to the rings.

During recent years hygienic considerations have led to the use of galvanised steel tubular divisions and stanchions in the equipment of the cow-house. It is claimed that the cows are kept clean, healthy, and comfortable under the

most sanitary conditions. The stanchions are hung on chains, allowing freedom for cows to lie down comfortably. They ensure cleanliness by keeping the cows in place—"forward" when lying down—"back" when standing. The cows have no weight to carry, and have perfect freedom for the neck. These sanitary cow-house fittings are sold by several manufacturers.

Troughs.—A feeding trough formed in cement concrete, and running the length of all the standings, is cheaper than any good form of separate trough; it can be more easily cleaned out, and, if supplied with a water-tap at one end and a waste outlet at the other, it makes an effective water-trough as well. The chief objection to the continuous trough is that tuberculosis may be conveyed from an affected to a healthy animal by the saliva of the former being carried down the trough.

In many districts a separate trough for each animal is preferred. These consist frequently of half-pipes set in concrete, with cement coping, or are constructed of brown glazed earthenware blocks. Where separate troughs are used water may be supplied in small circular troughs 9 in. or so in diameter, set in a recess cut out of the stall division, close to the wall or feeding-passage division, and about 1 ft. above the trough. These water-troughs should have a balanced lid which is hinged at the back and projects over the edge $\frac{1}{2}$ an in. or thereabouts, and is so arranged that it cannot be lifted quite up to a perpendicular position. All stock seem to learn to lift the lid with their nose in a few days, and as soon as they have satisfied their thirst, the lid falls and keeps out dust, straw, &c. The level of the water in the troughs may be automatically regulated by a ball cock.

Manure Channel.—Probably no part of the average cow-house is constructed in so faulty a manner as the manure channel. In no case should it be less than 16 in. wide, and in erecting new cow-houses a width of not less than 24 in. should be allowed. It need not be of greater depth than 6 in. at the cow's heels, and at the side next the passage 4 in. will be quite enough. The channel should have a fall of $1\frac{1}{2}$ in. towards the gangway, and a semi-circular channel for the liquid formed at the back about 3 in. wide, as shown in C., Fig. 4. It is undesirable to give more than 2 to 3 in. of fall from the feeding trough to the channel. A fall of $\frac{1}{2}$ an in. per yard run in the length of the channel is sufficient. If the channel is any narrower than suggested it may quickly become blocked with manure, and the urine collect between each heap of manure, the result being that when a cow lies down her tail may drop into the pool of urine; under such conditions milk is almost certain to be contaminated.

Air and Floor Space.

Floor Space.—The provision of sufficient floor space is of great importance. When the floor space per cow is insufficient the operations of feeding and milking and the removal of the manure are hampered, while it is more difficult to ensure clean milk. Although the actual area required by a cow for her comfort is regulated by her size, it is unnecessary to consider the size of the individual cow in determining the total area required. With passages of the width suggested for the different designs of cow-houses, a floor space of not less than 45 square feet will be provided per cow.

Cubic Space.—Opinions as to the suitability or unsuitability of a cow-house from a sanitary point of view are frequently based on the amount of cubic space provided. This is due to the idea that in a building with a large cubic space the air remains approximately pure much longer than where the cubic space is smaller. Where buildings are occupied for a comparatively limited time, the inference is reasonably sound, but when applied to the case of a cow-house in which the animals are constantly stalled for half the year it is open to criticism. In the one case the building is frequently flushed with fresh air, whilst in the other this is only possible on rare occasions. Still, even in relatively large cow-houses, the air reaches a high degree of impurity shortly after the building becomes occupied, unless provision is made for ample ventilation.

This was strikingly brought out in the experiments carried out by the Highland and Agricultural Society during the winter of 1908 and 1909*. These experiments showed that there is no substantial gain in purity of the air, in buildings of very large cubic capacity per cow compared with those of more moderate size, and that if any cow-house, no matter what its cubic space per cow, is kept at a temperature of 60° F. or more, its air will contain about three times as much carbon dioxide as if the building were freely ventilated and kept at under 50° F. While the production of milk may be as great in the one case as in the other, the health of the animals in a freely ventilated small building will be better than of those in a larger but poorly ventilated building.

The cow-house must comply with the requirements as to floor area or cubic space laid down by any regulations adopted by the local authority under the Dairies, Cowsheds and Milk Shops Order. The usual minimum space prescribed is 800 cubic ft. per cow in cases where the cows are constantly kept and fed in the building, and 600 cubic ft.

* See *Journal of the Board of Agriculture*, Oct., 1909, pp. 550-552.

where they are habitually turned out for at least part of the day. In reckoning the cubic space it is usual to leave out of consideration anything above 12 ft. in height from the floor. This is perhaps not unreasonable with the ordinary type of roof, in which there may be a zone of more or less stagnant air.

Ventilation.

Closely associated with cubic space, but in reality quite distinct, is the question of ventilation. While a certain floor and cubic space must be provided before the cows can be conveniently and economically attended to, the health of the animals and purity of the milk will depend to a great extent on the means provided for ventilating the building. Special systems of ventilation are by no means essential. Openings in the walls to serve as inlets for the air, and similar openings in the roof to serve as outlets will be quite effective, provided they are sufficient in number and size. Apart from windows the area of inlets should not be less than 40 sq. in. per cow: the area should be larger if the situation is at all sheltered. It does not follow that all available ventilation should be always made use of, but sufficient openings should exist to keep the air fresh, when the stock are in, and the air is calm. These openings should be provided with some arrangement by which the inlet of air can be easily regulated to suit the conditions of the weather.

The arrangements for the effective ventilation of cow-houses may be of the most simple kind. Air may be admitted by ventilating gratings, or drain pipes built in the wall about $5\frac{1}{2}$ or 6 ft. from the floor. Windows constructed of the hopper, louvre, or hit-and-miss slide types will also be of great assistance in providing ventilation. Perhaps the most satisfactory window for a cow-house is the hopper type, (see A. and B. in Fig. 4). With this type draughts are prevented, and if the cows face outward, they get the benefit of the fresh air, while the odour and steam from the manure passes behind them and rises to the ventilating ridge. The best position for air outlets is admittedly the apex of the roof; simply and economically attained by raising any desired number of ridge tiles, superimposed and bedded upon the adjoining ones.

This will be ample for tile roofs, whether plain or pantiled, and in most cases will also suffice for slate coverings.

Small and frequent openings in the roof are preferable to large outlets, as the down draughts are less, and the fresh air is distributed more thoroughly where the outlets are smaller individually than the inlets, but greater in their collective area.

Light.

The lighting of cow houses is a matter of no little importance. Good lighting is essential for clean milking. Moreover, sunlight is one of the most powerful germicides, and should, therefore, be admitted freely into all buildings occupied by stock.

The simplest and cheapest means of lighting is to use a number of glass pantiles or slates in the roof, but the light from this source should be supplemented by that obtained from the upper part of any windows in the walls.

In estimating the total lighting area required for a cow-house 3 sq. ft. should be allowed for each cow.

Whitehall Place, London, S.W.,
September, 1911.

Revised, August, 1916.

Copies of this leaflet may be obtained free of charge and post free on application to the Secretary, Board of Agriculture and Fisheries, Whitehall Place, London, S.W. Letters of application so addressed need not be stamped.

Bound Volumes of Leaflets.

Leaflets Nos. 1-100, Nos. 101-200, and Nos. 201-300 are offered for sale bound in stiff boards in single volumes, price 1s. 0d. net each volume, or the three volumes 2s. 6d., post free. These are obtainable only at the office of the Board of Agriculture and Fisheries, Whitehall Place, London, S.W.

Handbook of British Breeds of Live Stock.

This Handbook was originally prepared for the Brussels and Buenos Aires International Exhibitions of 1910 with the special object of encouraging the export of British live stock. It has now been extensively revised, and it is hoped that it will prove of service to all who are interested in live stock, whether for exportation or otherwise.

In preparing the second edition, attention has been given to various points of practical importance with a view to making the Handbook still more useful, and, in particular, attention may be drawn to some tables which are given showing the average ages, live weights and daily increases of cattle, sheep and pigs at the Smithfield Shows for the past ten years. In the case of dairy cattle, milk yields have been given so far as they could be ascertained. This information has not been previously published in this form, and it is thought that it will prove a useful guide to the relative size, weight and productive capabilities of the different breeds.

Valuable information has also been supplied by the secretaries and councils of the various breed societies and of the Smithfield Club, who in many cases undertook the revision of the descriptions of their respective breeds. A statement of the more important shows and places at which animals of each breed can be bought is given, together with an indication as to the average range of prices. The Handbook now contains some 147 pages of letter-press, and 88 photographs of animals. Price 1s. post free, or bound in cloth, 2s. post free. The Handbook has also been published in French, Spanish, and Portuguese, and copies of these translations can be obtained price 1s. each post free.

OFFICIAL NOTICE.

THE JOURNAL

OF THE

BOARD OF AGRICULTURE

(PRICE 4d., Post Free)

IS
AN OFFICIAL AGRICULTURAL JOURNAL PUBLISHED ON THE
15TH OF EACH MONTH

BY THE
BOARD OF AGRICULTURE AND FISHERIES,
Whitehall Place, London, S.W.,
FOR THE BENEFIT OF AGRICULTURISTS.

CONTENTS.

The following are some of the principal articles which have appeared in recent numbers:—

April, 1916.

Economy in Food.
The Washing Out of Nitrate from Arable Soil during the Past Winter.
Fish Meal as Food for Pigs.
The Sale of Home-Grown Wool.
Two New Seedling Hops of Commercial Promise.
Co-operative Farm Implement Societies (cont.).
Mangolds or Swede Turnips for Dairy Cows.

May, 1916.

Identification of the Country of Origin of Commercial Oats.
Feeding Coconut Cake on Grass.
The Manurial Value of Sewage Sludges.

June, 1916.

Manurial Values of Concentrated Foods in Relation to Cost of Food in the Production of Milk.
Silage made from Oats and Tares as a Food for Milking-Cows.
Fecundity of Hens in Relation to Size of Egg.

At the present time an endeavour is being made to publish matter of definite interest and value under War conditions. Summaries of Agricultural Experiments, Notes on Agricultural Co-operation and Small Holdings, and Market Prices appear regularly. The JOURNAL is usually illustrated.

Farmers, land agents, landowners and others are asked by the Board of Agriculture and Fisheries to support their JOURNAL, which is definitely published for the benefit of all classes of agriculturists, and is accordingly sold at a very low price (see below). The JOURNAL should be bound and placed on the bookshelf of every agriculturist for reference purposes; it will answer a large number of questions which are put to the Board every month.

Three months, 1s.; Six months, 2s.; Twelve months, 4s. (Post Free).